

Explosive Joining

To permit metal joining operations under hazardous or inaccessible conditions—for example, joining structures in space or repairing nuclear reactors—Langley Research Center developed a small scale explosive seam welding process that allows remote joining and provides a joint with double the strength of the parent metal.

The basic technique, invented by Langley's Laurence J. Bement, involves use of very small quantities of ribbon explosive to create hermetically sealed joints. Joining is accomplished by the collision of the metal plates to be joined as they are slammed together by the force of the explosion. This collision causes a skin deep melt and ejection of oxide films on the surfaces being joined, allowing a linkup of electrons that produces superstrong, uniform joints.

The explosive technique can be used to join materials that otherwise would not join, including a wide variety of metals, alloys and combinations. It offers a number of advantages over mechanical fasteners, adhesives and other types of joining, and it has a wide range of potential applications.

Langley Research Center and inventor Bement provides technology transfer assistance to Demex International Ltd., Picayune, Mississippi, which has refined the NASA technology and adapted it to commercial applications, such as plugging leaking tubes in feedwater heaters (right and right below) used by utility companies. Demex produces the small plugs, their associated sleeves and detonators shown at top right. At center right is a closeup view of a plug being inserted in a feedwater heater tube sheet. At far right below is a microphoto of a plug/tube weld showing a "textbook" wave form that indicates a perfect weld.

Demex International teams with Southwestern Engineering Service Company, King of Prussia, Pennsylvania, which does the service



work; together they have made some 35,000 plug installations without an operational failure. The explosive welding technology, according to Southwestern Engineering, allows faster plugging, hence reduced downtime, cuts plugging costs and increases reliability.

